PM_{10} SIP

BASE YEAR

POINT AND AREA

INVENTORY PROTOCOL

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PM_{10} Base Year SIP Point and Area Inventory Protocol

Table of Contents

BASE YEAR PM_{10} SIP POINT AND AREA INVENTORY PROTOCOL

1. INTRODUCTION

The State of Utah developed a SIP for PM_{10} encompassing Salt Lake and Utah Counties in the early 1990's which was approved by the EPA in 1994. This SIP targeted the Utah's historical problem with secondary particulate formation during wintertime inversions along the Wasatch Front. During the time since the SIP was approved, ambient air monitoring data from a number of locations along the Wasatch Front have continued to be at or very near the National Ambient Air Quality Standards (NAAQS).

Although there have been no violations of the NAAQS in the nonattainment areas since the current SIP was implemented, UDOT expects that the next round of long-range transportation plans and transportation improvement plans, due in 2000 for Utah County and 2001 for Salt Lake County, will not be able to show conformity to the PM_{10} SIP. Much of this nonconformity is the result of EPA changes to mobile emissions models that were used to establish emission budgets in the current SIP. For this reason the UDAQ has decided to create an entirely new PM_{10} SIP. It is possible that the work product could turn out to be a Maintenance Plan, in which case the nonattainment areas could be redesignated to attainment.

An additional incentive for redoing the PM_{10} SIP is to fix elements of the current SIP which have created ongoing difficulties in implementation. When the existing SIP was developed, significant control strategies were implemented at most major point sources throughout the two nonattainment areas. This was done with point-specific emission limits, itemized in appendices to the SIP, and adopted into federal law. This creates an awkward situation when a source requests a revision to an approval order (Utah NSR permit) because until the change is approved by the EPA as a SIP revision, the source is subject to different State and Federal requirements.
A major consideration in redoing the PM_{10} SIP is that modeling tools have advanced in the years between the development of the current SIP in the late 1980's and today. The current SIP is based on dated receptor modeling and county-wide roll-back of PM_{10} , SO_2, and NO_x. For this new SIP/Maintenance Plan, UDAQ in consultation with the EPA Region VIII, has decided to take a two pronged approach to the attainment demonstration. This approach will consist of a grid-based aerosol modeling analysis using UAM-AERO and an observational model coupled with a speciated linear rollback. The attainment/maintenance demonstration would be based on the results of one or both of these models.

The basis for the modeling process is the inventory. This document explains the procedures the Utah Division of Air Quality will use to calculate 1996 base year emission estimates for area and point sources within the PM10 domain.

2. EMISSIONS DATA PREPARATION

The Utah Division of Air Quality (UDAQ) has developed a 1996 annual inventory for the state. The annual point source inventory for Salt Lake and Davis Counties consists of data on sources that have 10 tons/year of VOC or 25 tons/year of NO_x. UDAQ has data on sources in Utah and Salt Lake Counties with 25 tons/year of PM_{10} and SO_x. Inventory data has been gathered for Title V sources, major criteria and major HAP sources, New Source Performance Standard (NSPS), National Emissions Standards for Hazardous Air Pollutants (NESHAP), and Maximum Achievable Control Technology (MACT) sources. This data will be used to develop winter day inputs for PM_{10} emissions from the episode period spanning February 10 - 16, 1996.

PM10 domain area emissions will be calculated using methods outlined in EPA's current inventory development guidance, the "Emission Inventory Improvement Program (EIIP)", EPA-454/R-97-004a, July 1997, document. The various methods for individual area source categories are outlined in Section 5, *Area Source Emissions Data* of this document.

An ammonia inventory was not developed in 1996. However, ammonia data was requested from point sources in 1997 and 1998. This data will be used to complete an ammonia inventory of point sources. The 1996 throughput and emission factors from the "EPA Compilation of Air Pollutant Emission Factors", (AP-42) and "Development and Selection of Ammonia Emission Factors", EPA/600/R-94/190, August 1994, will be used to calculate the ammonia emissions. The area ammonia data will be calculated using the methods outlined in the section 5.14, *Ammonia Emission Sources*.

3. PM_{10} MODELING DOMAIN

The proposed emissions modeling domain consists of all or portions of Weber, Salt Lake, Utah, Davis, Morgan, Wasatch, Summit, Box Elder, Cache, Juab, Sanpete, Rich and Tooele counties. A map of the area follows. All but Salt Lake and Utah counties and Ogden City are currently designated as attainment of the federal PM_{10} standard.

4. DATA BASES

Base year 1996 emissions inventories for the study region will be developed from the basic annual 1996 emissions data set compiled by the Utah Division of Air Quality. The data will be analyzed for any data holes or inaccurate assumptions. Actions will be taken to modify the current data to be as accurate as possible considering the available resources. Potential actions are outlined in Section 9, *Revisions*. Any modifications will be documented. The periodic inventories for CO and ozone will be reviewed to see if any changes have an impact on these submittals. Actions that are needed due to any impacts will be negotiated with EPA.

5. AREA SOURCE EMISSIONS DATA

This section explains the area categories that will be included in the PM10 area source inventory. Many of these categories were included in the UDAQ 1996 statewide annual area emissions inventory during its development. Many of the methods used to calculate the annual area inventory categories are contained in EIIP. UDAQ will continue to use these methods. However, some of the methods have been updated. In order to comply with the EPA guidance, UDAQ will use methods outlined in EIIP for the area emission calculations unless otherwise specified in the following sections. The use of any method which deviates from EIIP will be explained and submitted for EPA approval.

Some categories have been included in the EIIP that UDAQ has not previously incorporated into the area inventory. These will be added to the PM10 emission inventory. In addition, there are categories which UDAQ believes to be significant emitters of PM10 and PM10 precursors that are not included in EIIP. These categories are being added to this inventory.

5.1 GASOLINE DISTRIBUTION

Calculation of Annual Emissions

Evaporative emissions are released any time a petroleum liquid is disturbed. This category estimates VOC losses beginning the moment refined fuels are loaded for distribution at each refinery until those fuels occupy individual vehicle tanks at a service station. Motor fuel consumption by month for the entire state of Utah is provided by the Utah State Tax Commission. The fuel consumption is then allocated to each county by population.

The fuel distribution process is divided into five distinct phases. Vapor loss occurs during each phase. These phases are:

(1) The loading of fuel at bulk terminals,
(2) The transport of fuel in tank trucks,
(3) The transfer of fuel from tank trucks to service station storage tanks,
(4) The breathing loss of fuel at service stations, and
(5) The transfer of fuel from service station tanks to private vehicle tanks.

A comprehensive discussion of the emissions from the first four phases is contained in Volume III Chapter 11 of the EIIP. Estimates of gasoline delivery emissions will be calculated using Method 1 of the above reference.

Emission factors for gasoline trucks in transit, fuel delivery to outlets, and storage tank breathing are all provided by EPA. No methodologies have been identified to replace the use of these emission factors. These emission factors are listed in the table below. Emission factors for vehicle refueling will be developed through the use of EPA's MOBILE model. This software uses local data (e.g., temperature, fuel volatility) to generate a custom VOC emission factor.

VOC EMISSION FACTORS FOR GASOLINE MARKETING ACTIVITIES [a]

Emission Source	mg/Liter Throughput	lb/1000 gal Throughput
Gasoline Tank Trucks in Transit		
Empty Tank Trucks [b]	6.5	0.055
Full Tank Trucks [c]	0.5	0.005
Filling Underground Tank (Stage I)		
Submerged Filling	880	7.3
Splash Filling	1,380	11.5
Balanced Submerged Filling	40	0.3

Underground Tank Breathing	120	1.0

a Source: AP-42 Tables 5.2-5, 5.2-7.

b Midpoint of typical range provided in AP-42. Under extreme conditions, the upper end of the range is 0.37 lb/1000 gal (44.0 mg/L).

c Midpoint of typical range provided in AP-42. Under extreme conditions, the upper end of the range is 0.08 lb/1000 gal (9.0 mg/L).

<u>Calculation of typical winter-day emissions</u>

Winter season daily emissions are calculated using the same method as for annual emissions, but some of the factors are different. For example, temperatures are lower during the winter months, while the RVP of gasoline is higher during the winter. Fuel consumption is reported by month statewide, so the wintertime fuel consumption is known.

The daily/hourly resolution shall be figured using the amounts in the following table.

DAILY AND HOURLY ALLOCATION OF GASOLINE DISTRIBUTION SYSTEM EMISSIONS

Subcategory	Daily Allocation (days per week)	Hourly Allocation (hours per day)
Trucks in Transit	6	24
Fuel Delivery to Outlets	6	24
Vehicle Refueling	7	24
Storage Tank Breathing	7	24

5.1 DRY CLEANING

Dry cleaners were surveyed and inspected statewide. Only one dry cleaner has significant emissions. This source is included in the point source emissions inventory.

5.3 SOLVENT CLEANING (Previously named Surface Cleaning - Degreasing Emissions)

<u>Calculation of Annual Emissions</u>

The method used to calculate emissions from this process was per capita as presented as the Alternative Method in Volume III Chapter 6 of the EIIP.

The emissions factors included in this category are:

Automobile Repair	2.5 lb/yr/person
Electronics and Electrical	0.21 lb/yr/person
Other	0.49 lb/yr/person

The manufacturing portion of this category is accounted for in the point source emissions. The 1.1 lb/capita factor for manufacturing was deducted from the total 4.3 lb/capita factor resulting in a factor of 3.2 lb/capita. The county populations were obtained from the Utah Governor's Office of Planning and Budget.

The equation that was used is:

(population) x (3.2 lb VOC/yr/capita) / (2000 lb/ton) = VOC tons/yr

Solvent cleaning emissions factors include emissions from small cold cleaners, permitted facilities that are not inventoried, and unpermitted facilities.

<u>Calculation of typical winter-day emissions</u>

This type of work is typically done six days a week (312 days per year) in this area. No seasonal adjustments are warranted.

(VOC tons/yr) / (312 days/yr) = VOC tons/day

5.4 SURFACE COATINGS

5.4.1 Industrial Surface Coating

<u>Calculation of annual emissions</u>

The Division of Air Quality previously has not included the category of Industrial Surface Coating Emissions in the area inventory. This category is included in the EIIP and will be calculated on a per capita basis using the industrial emission factors included in the current guidance. The emission factors are as follows:

Furniture and Fixtures	2.0 lb/capita/yr

Metal Containers	1.3 lb/capita/yr
Machinery and Equipment	1.1 lb/capita/yr
Appliances	0.2 lb/capita/yr
Other Transportation Equipment	0.2 lb/capita/yr
Sheet, Strip, and Coil	0.5 lb/capita/yr
Factory Finished Wood	0.3 lb/capita/yr
Electrical Insulation	0.1 lb/capita/yr
Other Product Coatings	0.6 lb/capita/yr
High-Performance Maintenance Coatings	0.8 lb/capita/yr
Marine Coatings	0.2 lb/capita/yr
Other Special Purpose Coatings	0.8 lb/capita/yr
TOTAL	8.1 lb/capita/yr

The emission factor for "Automobiles (new)" was deleted for the EIIP list because there are no automobile manufacturing companies in Utah.

County populations are obtained from the Utah Governor's Office of Planning and Budget.

(Population) x (8.1 lb VOC/yr/capita) / (2000 lb/ton) + VOC tons/yr

Calculation of typical winter-day emissions

Industrial Surface coating is considered to be a 5 day a week activity, 260 days a year.

(VOC tons/yr)/ (5 days/wk x 52 wk/yr) = VOC tons/day

5.4.2 TRAFFIC MARKINGS (Previously included under non-industrial surface coating)

Traffic marking operations consist of marking of highway center lines, edge stripes, and directional markings and painting on other paved and unpaved surfaces, such as markings in parking lots. Materials used for traffic markings include solvent-based paints, water-based paints, thermoplastics, preformed tapes, field-reacted materials, and permanent markers. Solvent-based formulations of alkyd resins or chlorinated rubber resins are the most commonly used traffic paints. This category focuses on applications of traffic paints that emit a significant quantity of volatile organic compounds (VOCs). The use of traffic paints is entirely an area source.

Traffic paints are applied by maintenance crews or by contractors during new road construction, resurfacing, and other maintenance operations. The method of application is usually a spray.

The paints are subjected to harsher conditions than most other paints and must withstand wear from tires, rain, sun, and other environmental factors for a considerable period of time. Solvent- and water-based paints have roughly the same durability, with both beginning to deteriorate about a year after their application. Both solvent- and water-based paints must be applied in dry conditions and at temperatures above 40 ^{o}F. If applied properly, water-based paint is considered to be of better quality than solvent-based paint; however, application of water-based paint is more susceptible to weather constraints such as humidity. Plastic-based paints (i.e., thermoplastics, preformed tapes, and field-reacted systems) are more durable than either solvent- or water-based paints.

Calculation of annual emissions

VOC emissions result from the evaporation of organic solvents during and shortly after the application of the marking paint. Of the painting materials commonly used for traffic marking, three types emit VOCs in appreciable amounts:

- Nonaerosol traffic paint, water- and solvent-based: Solvent-based paints include eliphatic hydrocarbons, toluene, xylene, ketones, and chlorinated hydrocarbons. Water-based paints contain some organic solvent components, usually emulsions of glycols and alcohols; however, the VOC emissions are considerably lower than those from solvent-based paints.

- Aerosol marking paint, water- and solvent-based: These paints are used to apply stripes or markings to outdoor surfaces, such as streets, golf courses, athletic fields, or construction sites. Markings can be either temporary or permanent. Section 5.8, *Consumer and Commercial Solvent Use*, includes an emission factor of 0.0254 lb/person for the use of these products. Total annual emissions in the U.S. for this subcategory are estimated as 3,154 tons of reactive VOC per year. Emissions from these paints are not included in this section.

- Preformed tapes applied with adhesive primer: Emissions from traffic marking adhesives are included as part of Section 5.8, *Consumer and Commercial Solvent Use*, under the subcategory of "other adhesives." Emissions from these adhesives are not included in this section.

VOC emissions are negligible from application of some alternative paints including thermoplastics, preformed tapes with no adhesive primer, and two-component, field-reacted systems. In addition to the painting material used, VOCs from solvents utilized in cleaning the striping equipment is quantified in this category.

UDAQ will be using Alternative Method 2 in Volume III, Chapter 14 of EIIP to calculated emissions from this category. This method uses an emission factor for lane miles of road painted paired with local data. The emission factors are from a 1988 Control Technology Center (CTC) report (EPA, 1988). Emission factors for solvent- and water-based traffic paints, and for lane miles painted or total lane miles are shown below.

Utah Department of Transportation will provide the number of lane miles in each county, allowing UDAQ to utilize this method. The national default factor for typical annual emissions, in units of pounds per mile and year will be used. The emission factors for solvent-based paints will be used if information about the proportions of solvent-based versus water-based paint is not available. This will result in the most conservative estimate. However, UDAQ would prefer to gather information about the proportions of solvent-based versus water-based paint if at all possible.

The equation used to calculate emissions using these emission factors is:

Inventory Area
Emissions from = Emission Factor (lb/mile-year)[a] * Traffic Lane miles
Traffic Paints

The method does not take into account any region-specific use of lower-emitting coatings, such as water-based coatings or thermoplastic tapes. Using the typical annual emissions factor with total lane miles also will not reflect area-specific repainting schedules.

LANE MILE VOC EMISSION FACTORS (EPA, 1988)

Traffic Paint Type	Typical Expected Life (years)	Typical Annual VOC Emissions (lb/mile-year)[a]
Solvent-based	0.75	69
Water-based	1.0	13

Calculation of typical winter-day emissions

It is assumed that painting operations will occur 235 days per year (9 months/year, 6 days/week, 8 hours/day). If the temperature maximum is equal or greater than 55 ^{o}F according to the National Weather Service data, it is assummed that painting occured on that day.

5.4.3 ARCHITECTURAL COATING

Calculation of annual emissions

There are several methodologies available for calculating emissions from architectural surface coatings. The method used is dependent upon the degree of accuracy required in the estimate, available data, and available resources. Since architectural surface coatings can be the largest single area source of

VOCs in some metropolitan areas, this category warrants the time and effort needed to calculate emission estimates for it.

Most VOC released by these coatings are from the evaporation of VOCs (i.e. drying process) contained in the coating, coating thinners, and thinners used for cleanup. Determining the amount of the VOC in coatings and thinners provides a good estimate of the VOC emitted by this source category. This estimating can be done by survey or population-based estimation methods.

There may be cases when emission estimates from this category may be estimated as one of many processes occurring at a point source for the purposes of permitting and emission tradeoffs. These emissions must be identified and subtracted from the area source estimates.

UDAQ will use the alternative method outlined in Volume III, Chapter 3 of EIIP for calculating emissions from architectural surface coating which uses population-based usage and emission factors. The procedure is as follows:

- Determine the per capita usage factor by dividing the national total architectural surface coating quantities for solvent and water based coatings by the U.S. population for that year.
- Determine the VOC emission factors for solvent- and water-based coatings. Emission factors based on weighted averages from a 1990 survey study are listed below. These emission factors are based on the weighted average VOC emission at maximum thinning.

The per capita usage factor is calculated by dividing the total usage of solvent based paints by the U.S. population, and the total usage of water based paint by the U.S. population.

Per Capita Solvent Based Usage Factor	=	Gallons of Solvent Based Paints/Population
	=	146,301,000/248,709,873
	=	0.59 gallons per person

For water based paints:

Per Capita Water Based Usage Factor	=	Gallons of Water Based Paints/Population
	=	452,506,000/248,709,873
	=	1.82 gallons per person

a This figure will be updated for each periodic inventory and the emission factors recalculated.

Calculation of typical winter-day emissions

The use of architectural surface coatings is influenced by the seasons since spreading and drying characteristics for many paints are dependant on the temperature. Temperatures below 50°F are not suitable for painting, and limit activity. Some painters work around this problem by heating the rooms in which they paint. Regardless, overall activities are restricted. To account for this issue, apportionment of annual emissions will be based on the heating degree days in each county of the domain.

5.4.4 AUTO BODY REFINISHING

Calculation of annual emissions

Auto body refinishing is the repairing of worn or damaged automobiles, light trucks, and other vehicles, and refers to any coating applications that occur subsequent to those at original equipment manufacturer (OEM) assembly plants. (Coating of new cars is not included in this category.) This category covers solvent emissions from the refinishing of automobiles, including paint solvents, thinning solvents, and solvents used for surface preparation and cleanup.

Auto body refinishing shops range in size from small shops having less than five employees to volume or "production" shops with over ten employees. Data from 1987 show that the typical refinishing shop employs six persons and performs an average of 13 jobs per week.

Most auto refinishing jobs are performed as part of a collision repair and involve only a small portion of a vehicle, such as a panel or a spot on a panel ("spot" repair). About 17 percent of refinishing jobs involve the entire vehicle. For a typical shop, approximately 90 percent of the work consists of spot and panel repairing, and the entire vehicle is completely refinished only about ten percent of the time. Shops specializing in repainting entire automobiles are referred to as "production" shops.

Auto body refinishing shops may be area or point sources, but the majority of shops are considered area sources of emissions. Point source emissions must be subtracted from total emissions to produce an estimate of auto body refinishing area source emissions.

UDAQ will use Alternate Method 3 of Volume III, Chapter 13 of EIIP to calculated these emissions. This method multiplies population in the inventory area by a per capita VOC emission factor to estimate emissions:

$$E_a = Pop_a \times EF$$

where:	E_a	=	emissions for the area
	Pop_a	=	area population
	EF	=	per capita VOC emission factor

The county populations were obtained from the Utah Governor's Office of Planning and Budget. The per capita VOC emission factor of 2.3 pounds per year, recommended in EIIP, will be used. UDAQ will subtract any point source emissions for this category from the emissions total generated using the above equation.

Calculation of typical winter-day emissions

EPA reports that auto body refinishing emissions do not demonstrate differences in activity from season to season. However, other references have indicated that since there is a direct relationship between auto body refinishing activity and number of automobile accidents, if there is a seasonal difference in accident occurrence, the same seasonal variation may be seen in auto body refinishing activity. UDAQ will review annual accident statistics from the National Safety Council and/or survey results to determine if any seasonal variability exists for the domain area.

To calculate daily emissions, EIIP indicates that auto body refinishing shops typically operate five days per week.

5.5 GRAPHIC ARTS

Calculation of annual emissions

Emissions of VOC from graphic arts facilities was estimated by using Alternative Method 2 outlined in Volume III Chapter 7 of the EIIP. An emission factor of 1.3 pounds of VOC/capita/year was applied. The county populations were obtained from the Utah Governor's Office of Planning and Budget. To avoid double counting, any identified graphic art point source emissions with VOC emissions of less than 100 ton/year will be subtracted out as outlined in the EIIP guidance. The emission factor is independent of facilities with emissions greater than 100 tons/year in the inventory area.

(population) x (1.3 lb/VOC/yr/capita) / (2000 lb/ton) = VOC ton/yr.

Calculation of typical winter-day emissions

There are no dramatic seasonal fluctuations in production in the graphic arts industry; therefore, it can be assumed that emissions are distributed uniformly throughout the year. To determine seasonal emissions, the fraction of the year that corresponds to the season of interest can be multiplied times annual emissions to obtain seasonal emissions. It is assumed that graphic arts operations will operate 260 days per year (5 days/week over 52 weeks/year) and that emissions are equal over those 260 days.

5.6 ASPHALT PAVING (Previously named Cutback Asphalt Use)

Calculation of annual emissions of cutback

Emissions of VOC from cutback asphalt used in Utah were estimated by first determining total annual cutback asphalt usage per county, in tons/year. This information was obtained from the Utah Department of Transportation. The values were then converted to kg/year (2000 lb/ton, 0.45 kg/lb).

Other providers of asphalt were not taken into consideration. This oversight will be corrected for the PM_{10} SIP inventory.

Medium cure cutback asphalt (MC) is primarily used in Utah, along with small amounts of high cure cutback asphalt (HC). The densities for both asphalt types were obtained from AP-42 Section 4.5. Rapid cure cutback evaporative losses are estimated at 95% by weight of diluent. Medium cure evaporative losses are estimated at 70% by weight of diluent, and slow cure at 25 percent by weight of diluent. This information was used to calculate the volume of diluent used for each type of asphalt.

As a first step, the weight of asphalt applied is converted from tons to kg.

W_T and W_D = Total weight of asphalt and weight of diluent
V_D and V_C = Volume of diluent and cement
D_D and D_C = Density of diluent and cement
P_D = Percent diluent by volume

From AP-42: $W_T = V_D D_D + V_C D_C$
and $V_D = P_D(V_D + V_C)$

Solving these equations for V_D:

Asphalt Type	D diluent	D cement	P (% diluent)
Medium Cure	0.8 kg/*l*	1.1 kg/*l*	35%
Rapid Cure	0.7 kg/*l*	1.1 kg/*l*	45%

The diluent is the source of VOC emissions. The total weight of diluent was determined to be:

$$W_D = V_D D_D$$

Volume III Chapter 17 of the EIIP gives the evaporative losses as 70% of medium cure diluent and 95% of rapid cure diluent. Therefore, medium cure emissions equal:

$$W_{VOC} \text{ from MC asphalt} = W_D \ (0.70)$$
$$W_{VOC} \text{ from RC asphalt} = W_D \ (0.95)$$

As a final step, kg/yr VOC is converted to tons/year VOC.

Calculation of typical winter-day emissions

Cutback asphalt application is prohibited in Salt Lake and Davis Counties except from October 1 to April 30 per the Utah Air Conservation Rules R307-341. Due to the time delay of VOC emissions from asphalt, it is assumed that emissions occur 7 days/week during the paving season.

UDAQ will research how to apportion the emissions of cutback asphalt to a winter day.

5.6a EMISSIONS FROM EMULSIFIED ASPHALT USE

Emissions of VOC from emulsified asphalt were determined to be zero or negligible. This was determined after discussing the matter with Cameron Petersen, the Lab Specialist at the head office of the Utah Department of Transportation. In summary, the soap used by UDOT does not contain volatile organic compounds. The same is true of independent contractors using emulsified asphalt within the emissions area.

5.7 COMMERCIAL & CONSUMER PESTICIDE APPLICATION

Calculation of annual emissions

Pesticides are substances used to control nuisance weeds (herbicides), insects (insecticides), fungi (fungicides), and rodents (rodenticides). Pesticides can be broken down into three chemical categories: synthetics, nonsynthetics (petroleum products), and inorganics. Formulations of pesticides are made through the combination of the pest-killing material referred to as the active ingredient, and various solvents (which act as carriers for the pest-killing material) referred to as the inert ingredient. Both types of ingredients contain volatile organic compounds (VOC) that can potentially be emitted to the air either during application or as a result of evaporation.

Pesticide applications can be broken down into two user categories: agricultural and nonagricultural (which includes municipal, commercial, and consumer). The criteria pollutant of concern from the application of pesticides is VOC. Pesticides are used mainly for agricultural applications. Agricultural pesticides are a cost-effective means of controlling weed, insects, and other threats to the quality and yield of food production. Application rates for a particular pesticide may vary from crop to crop and region to region. Application of pesticides can be from the ground or from the air and pesticides can be applied as sprays, dusts, pellets, fogs, or through other dispersion techniques.

Nonagricultural applications are a smaller part of the inventory and include municipal, commercial, and consumer applications. Municipal applications cover state and possibly public institutions such as schools and hospitals, and public recreational areas. Municipal applications can include mosquito control and weed suppression by government agencies, pesticide application at parks, highway department use, utilities maintenance, and pesticide application at railroad right-of-ways. Commercial applications include applications to public and private golf courses and homeowner/business property (yards, dwellings, and buildings) by a commercial exterminator/lawn care service. Consumer applications include homeowner-applied insecticides (*e.g*., flea and tick sprays, wasp and hornet sprays, lawn and garden insecticides), fungicides and nematicides (*e.g.*, wood preservatives, and mold and mildew retardants), and herbicides (*e.g.*, defoliant herbicides, swimming pool algicides, and aquatic herbicides). As with agricultural applications of pesticides, nonagricultural applications can be from the ground or from the air and pesticides can be applied as sprays, dusts, pellets, fogs, or through other dispersion techniques.

Currently, the emissions for this process are calculated in the following manner:

1. Commercial/Consumer Application of Pesticides

The emissions for commercial/consumer pesticide usage is 0.25 lb/capita/year, as taken from Procedures for Emission Inventory Preparation, Volume III: Area Sources; EPA-450/4-81-026c September 1981, page 5-14. The county populations were obtained from the *Governor's Office of Planning and Budget*.

2. Agricultural Application of Pesticides

After contacting the local, state, and federal agricultural departments and finding they have no records of the volume of pesticides used, Tim Russ of the *Environmental Protection Agency* agreed to the use of the low pesticide consumption factor of 2 lb/yr-harvested acre, as published in Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone; Volume I: General Guidance for Stationary Sources; EPA-450/4-91-016 May 1991., pages 4-31 and 4-32. The people contacted in the agricultural departments indicated that inorganic pesticides are most commonly used in this area.

The agricultural crop evaporative VOC emissions were estimated using the 0.9 factor from Volume III, page 5-14. Harvested-acre totals by county were obtained from the Utah Agricultural Statistics document.

(Harvested Acres) x (2 lb pesticide/acre/yr) x (0.9 lb VOC/lb pesticide) / (2000 lb/ton) = VOC tons/yr

None of the methods in Volume III, Chapter 9 of the EIIP exactly match this process. UDAQ will negotiate with EPA to determine if the above method can continue to be used.

Calculation of typical ozone day emissions:

A 184-day growing season was established due to seasonal air temperatures.

(VOC tons/yr) / (184 days/yr) = VOC tons/day

5.8 COMMERCIAL/CONSUMER SOLVENT USE

Calculation of annual emissions

The VOC emissions from commercial and consumer solvents are determined by using the per- capita method described in Volume III Chapter 5 of the EIIP. County population statistics are obtained from the Utah Governor's Office of Planning and Budget. Previously the annual emission factor of 6.3 lbs of VOC emitted per capita was applied. However, some of the product categories and emission factors have been updated by the current EPA guidance. The new proposed annual emission factor of 7.84 pounds of VOC per capita will be used to calculate emissions from this category. The 7.84 lb per capita covers:

Personal Care Products	2.32 lb/capita/year
Household Products	0.79 lb/capita/year
Automotive Aftermarket Products	1.36 lb/capita/year
Adhesives and Sealants	0.57 lb/capita/year
Coatings and Related Products	0.95 lb/capita/year
Miscellaneous Products	0.07 lb/capita year
Total	6.06 lb/capita/year

UDAQ has a category for pesticides which are FIFRA-Regulated Products. This has been removed from this category to avoid double counting between two area source categories: Commercial/consumer solvent use and pesticide application.

The following equation was used to determine annual VOC emissions:

(population) x (6.06 lb VOC/capita/yr) / (2000 lb/ton) = VOC tons/yr.

Calculation of typical winter-day emissions:

The use of solvents is considered a uniform activity, 365 days a year.

(VOC tons/yr) / (365 days/yr) = VOC tons/day.

5.9 WASTE MANAGEMENT PRACTICES

5.9.1 TREATMENT, STORAGE, AND DISPOSAL FACILITIES (TSDFs)

The emission inventory should include estimated VOC emissions from any existing TSDFs in the domain. In a February 24, 1993, letter from Tim Russ, EPA Region VIII, to UDAQ, EPA provided assistance in identifying and estimating VOC emissions from TSDFs. Attached to this letter was a list of sites from the federal Office of Solid Waste's databases which identified permitted RCRA facilities within Salt Lake and Davis Counties. (This category is not included in EIIP)

The provided list and the possibility of other non-permitted existing TSDFs was discussed in detail with appropriate representatives from the Utah Division of Solid and Hazardous Waste: Phillip Burns, scientist with the solid waste section; John Waldrip, engineer with permitting hazardous waste section and Don Verbica, manager of compliance hazardous waste section. The list and possible existence of other non-permitted sites was also discussed with former compliance inspectors from the Utah Division of Air Quality, Rebecca Hillwig and Cheryl Prawl. All were asked in separate meetings to provide information about the TSDFs on the list, whether or not the sites existed in 1990 and the existence of any other sites in the nonattainment area that were not permitted in 1990. All interviews resulted in similar responses which are summarized below for each TSDFs listed. All agreed, to the best of their knowledge, that there were no unpermitted TSDFs in existence in the nonattainment area in 1990.

Best West Oil Co. /Flying J. Inc - no aerated/non-aerated impoundments, on-site landfills or land treatment existed in 1990.

Ashland Chemical - no aerated/non-aerated impoundments, on-site landfills or land treatment in 1990, only totally enclosed tank storage and drums.

Golden Eagle Environmental - no aerated/non-aerated impoundments, on-site landfills or land treatment in 1990, only totally enclosed tank storage facilities and drums.

Hill Air Force Base - no aerated/non-aerated impoundments, on-site landfills or land treatment in 1990, only totally enclosed tank storage facilities and drums.

Syro Steel Company - they have a small impoundment that temporary collects "pickle liquor" used in their process but it is not comprised of any VOCs according to Division of Solid and Hazardous Waste records.

Amoco Closed HWMF - no aerated/non-aerated impoundments, on-site landfills or land treatment in 1990.

Amoco Oil Company Salt Lake Refinery - ground water contamination only but not from existing aerated/non-aerated impoundments.

Chevron USA Refinery - no aerated/non-aerated impoundments, on-site landfills or land treatment in 1990, only enclosed tank storage facilities and drums.

Great Western Chemical Co - no aerated/non-aerated impoundments, on-site landfills or land treatment in 1990, only totally enclosed tank storage facilities and drums.

Harshaw Chemical Co (catalyst recycling) - no aerated/non-aerated impoundments, on-site landfills or land treatment in 1990, only totally enclosed tank storage facilities and drums.

Hercules Inc. - no aerated/non-aerated impoundments, on-site landfills or land treatment in 1990, only totally enclosed tank storage facilities and drums.

Petrochem (Ekotek) - no aerated/non-aerated impoundments, on-site landfills or land treatment in 1990, only totally enclosed tank storage facilities and drums.

Safety Keen Corp (solvent recycling) - no aerated/non-aerated impoundments, on-site landfills or land treatment in 1990, only totally enclosed tank storage facilities and drums.

University of Utah - no aerated/non-aerated impoundments, on-site landfills or land treatment in 1990, only totally enclosed 55 gallon drums.

In conclusion, the data indicates that there were no permitted nor non-permitted aerated/non-aerated impoundments, on-site or off-site landfills or land treatment facilities in existence in 1990 none were created from 1990 through 1996, therefore no VOC emissions are included in the area source inventory from this category.

5.9.2 ESTIMATE OF VOC EMISSIONS FROM INDUSTRIAL WASTEWATER TREATMENT

All VOC emissions from existing on-site wastewater treatment facilities within a stationary point source were included as part of the stationary point source VOC emissions.

5.9.3 ESTIMATE OF VOC EMISSIONS FROM PUBLICLY OWNED TREATMENT WORKS (POTWs)

<u>Calculation of annual emissions</u>

As suggested in "Quality Review Guidelines for 1990 Base Year Emission Inventory" EPA 450/4-91-022, September 1991, page 4-7, the SIMS model was used in accordance with the guidance in the

"Background Document for the Surface Impoundment Modeling System (SIMS) Version 2.0, EPA - 450/4-90-019b to estimate VOC emissions from POTWs.

There are a total of six POTWs in Salt Lake and Davis Counties. This number was originally obtained from Mary Deloretto, engineer with the Utah Division of Water Quality and later verified by POTW representatives. All six facilities were contacted and the minimum data obtained from each POTW to run the SIMS model and produce the estimated VOC emissions from each POTW.

POTW	Contact	Phone Number
Salt Lake City Public Utilities	Bill Farmer	483-6772
Central Valley Reclamation Facility	Bill Fox	973-9100
South Valley Water Reclamation Facility	Norris Palmer	566-7711
North Davis County Sewage District	Jeff MacFarlane	825-0712
South Davis Water District	Dal Wayment	295-3469
Central Davis County Sewer District	Leland Myers	451-2190

The selection of the industry categories that comprise the percent industrial contribution was provided by the POTWs.

The SIMS model calculates VOC emissions based on percent industrial contribution to total wastewater flow. Because Central Davis County Sewer District reported 0% industrial contribution, the model could not be run for this source, and emissions are reported as zero.

A survey will be conducted to find any additional POTW's in the domain. Data to run the SIMS model will be gathered for any additional facilities and emissions will be included in the modeling process.

<u>Calculation of typical winter-day emissions:</u>

Although POTW equipment operates seven days a week, the industrial waste yields most of the VOC emissions. For this reason, emissions are distributed over 6 days per week year-round.

(VOC tons/year) / (312 days/year) = VOC tons/day

5.9.4 MUNICIPAL LANDFILLS

<u>Calculation of annual emissions:</u>

There are a total of five large municipal landfills in Salt Lake and Davis Counties. These landfills are included in the point source inventory. They include E.T. Technologies, Salt Lake Valley Solid Waste Management, Trans-Jordan Landfill, Davis County Landfill, and Bountiful City Landfill.

An estimate of the amount of waste in place in 1996 for all the small landfills in Utah was gathered for the Code of Federal Regulations (CFR) Part 40 Subpart 61 Section WWW regulation. This data will be used to determine the episode day modeling.

Future estimates of emissions from medium sized landfills will be calculated using alternative method 1 of Volume III Chapter 15 of EIIP.

This method is a set of decision-making rules to follow for data collection of landfill waste in place and landfill opening and closure dates used in the AP-42 equation or the LAEEM and assumptions to use when local data are not available.

The landfills in the inventory area will be identified by reviewing the inventory done for 40 CFR Subpart 61 Section WWW. UDAQ will decide which of the smaller landfills in the domain emitted emissions significant enough to warrant the effort needed to produce emission estimates from them. Waste in place estimates will be made using either the LAEEM utility for estimating refuse in place or determine weight and converting this to volume using AP-42 equations.

This alternative method will allow UDAQ the opportunity to prepare fairly reliable estimates for the largest landfills in the inventory area and more uncertain and more conservative estimates for the smaller landfills.

<u>Calculation of typical winter-day emissions:</u>

Landfill emissions were assumed to be a uniform activity, 365 days a year.

(VOC tons/yr) / (365 days/yr) = VOC tons/day.

5.10 LEAKING UNDERGROUND STORAGE TANKS (LUST)

Utah Division of Emergency Response and Remediation track the leakage and replacement of above and below ground fuel storage tanks statewide by county. That office routinely reports *remediation* *starts* to us, marking the beginning of a multi-month cleanup process.

The process that was done for the 1996 ozone periodic inventory will be repeated for the PM10 SIP inventory.

An estimate of the 1996 VOC emissions from the LUST sites located in the domain will be determined using the method set forth in the memorandum dated May 5, 1992 from Glen Rives and Lauren Elmore of Radian.

A report of the remediation activities in the domain will be supplied by the Utah Division of Environmental Response and Remediation (DERR). The Division of Air Quality will look at the date by which DERR approved a contractors corrective action plan, (CAP) for a particular site and use this as an indicator of the projects initiated during the episode days. This assumption is made due to the difficulty in pinpointing the actual start or completion date of each remediation.

According to R307-413-8, Utah Air Conservation (UACR), De Minimis Emissions from Air Strippers and Soil Venting Projects (Attachment 3), no person can conduct a soil decontamination project without a permit unless the emissions from that project are equal to or less than 1.5 tons per year of total hydrocarbons. Mr. Tim Blanchard of our staff reviews the soil remediation projects sent to us by DERR. He informed the inventory staff that the majority of those remediations reviewed were below 1 ton of emissions per project. Based on that information, plus that found in R307-6, UACR, it will be assumed that each site emits 1.5 tons of VOCs per project per year. This conservative estimate should account for the diminutive number of projects for which emissions may have exceeded the 1.5 ton per year allowed.

In an attempt to make the emissions calculations more accurate, the following additional information will be obtained from DERR to expand the calculation:

1) According to data supplied to EPA by several states covering the types of on-site technologies typically used at LUST sites, it was estimated that 80% of the emissions resulting from these on-site technologies were emitted into the air. This is expressed as .8 in the calculation.

2) The database used by DERR has been expanded since the base year inventory was prepared, and is now used by all of the project managers in the LUST section. Therefore, the database will be used to determine the total number of remediations initiated per year.

3) The average number of days a project will last will be determined using the worst case scenario of 1.5 tons per project per year (above this limit and the source needs a permit to remediate), and the 28 lbs/day default factor found in the May 15, 1992 memo.

Note: the 1.5 emission limit can be found in R307-6, De Minimis Emissions from Air Strippers and Soil Venting Projects. This calculation will be made to document that both the 1.5 limit found in the UACR and the 28 lb limit from the May memo are high estimates for this category.

4) To determine emissions for a episode day the total emissions for the season will be divided by 120, the number of days encompassed by the 1996 winter season.

The following calculation was performed to verify that the 1.5 tons/project/yr found in R307-6 and the 28 lbs/day default factor from the May 15, 1992 memo are high estimates of emissions for these projects. The tracking sheet indicates that many of these projects last well over a three month period. Each project lasts at least:

(1.5 tons/project) x (2,000 lbs/ton) / (28 lbs/day) = 107 days/project.

5.11 STATIONARY EXTERNAL COMBUSTION

5.11.1 ORCHARD HEATERS

The *Utah Fruit Growers Association* has reported steady-to-sharp decline in the use of orchard heaters from the early 1980s to the present. Prior to this decline, orchard heaters were only used marginally during their peak, usually during the early spring. Further, suburban sprawl has claimed most of the orchards and plantation farms throughout the Wasatch Front counties. Yet further, California (and other out-of-state) growers supply an increasing-large part of Utah's needs and newer technology replaces "smudge pots" and old-style oil-burning orchard heaters with fans or wind machines. For these reasons, statewide annual use was estimated at zero.

5.11.2 WOODBURNING/FIREPLACES

5.11.2a SPATIAL ALLOCATION

Calculation of annual emissions

Emission Factors

Emission factors for CO emissions for fireplaces were obtained from AP-42, Table 1.9-1. Units are pounds of pollutant per ton of wood burned.

The emission factors (EFs) for wood stoves were divided among several stove types. AP-42, Table

1.10-1 gives EFs for six types of wood stove. Of these six, UDAQ staff estimated that three types adequately cover wood stove use in Utah. These three types are Conventional, Non-Catalytic, and Catalytic stoves.

Relative Impact of Each Woodburning System

The PARIA survey was utilized to apportion wood stoves among the three stove types. PARIA surveyed 1005 households in Davis, Salt Lake, and Utah counties in February 1993 about their home-heating equipment and tendencies.

From the PARIA questionnaire, responses to the question "How old is your woodburning / coal stove?" were used as a surrogate question to estimate ownership of conventional, catalytic, and non-catalytic stoves. PARIA summarized the results of stove age in the appendix of this section. UDAQ made the assumption that all stoves "older than 10 years" are conventional stoves. Catalytic and non-catalytic stoves claim an increasing market share for more current age groupings. The responses are summarized below. These estimates resulted in a split of each heating system type are as follows:

Stove Age	Conventional	Non-Catalytic	Catalytic	All Types
Less than 1 year old	1	1	1	3
1 to 3 years	5	5	2	12
4 to 6 years	18	8	2	28
7 to 10 years	20	7	2	29
older than 10 years	28	0	0	28
Total	72	21	7	100

The "Canon City Element of Colorado SIP for PM10 Matter", July 1988, was used to estimate a split of 20:80 for fireplaces and wood stoves. The percentages are based on wood consumed, not heating system ownership. Intuitively, fireplaces comprise more than 20% of the number of systems. However, stove owners tend to burn larger quantities of wood. The stove percentages above were multiplied by 0.80 to determine the total percentage of wood consumed by fireplaces and each stove type. The emission factors for each type of burning system were then weighted by the percentage of wood burned, to arrive at an emission factor for the hybrid burning system (all types).

Type	% Wood Consumed	CO emissions (lb/ton)

Fireplaces	20%	252.6
Conventional Stoves	57%	230.8
Non-Catalytic Stoves	17%	140.8
Catalytic Stoves	6%	104.4
Weighted Factors - Hybrid System	100%	212.28

The wood consumption per capita of 0.1375 tons per person per year is documented in the Utah PM10 SIP. Population estimates were obtained from the Utah Office of Planning and Budget. Unit conversion is applied when needed. The basic equation is:

(population)x(annual wood consumed/person) x (lbs CO emitted/ton of wood) = uncontrolled annual tons of CO.
2.3-3 *EIIP Volume IV*

5.11.2b TEMPORAL RESOLUTION SEASONAL APPORTIONING

Residential wood combustion is strongly dependant on the season temperature. If the preferred method is used, the survey should attempt to collect information about wood burned during only the inventory months. The alternative to survey information is allocation using heating degree days.

The method for allocating residential wood burning using heating degree days is as follows:

- Obtain the number of heating degree days for the inventory season and for the entire year.
    - A heating degree day is a measure of the amount of heating necessary for a particular day. One heating degree day is registered for each degree below 65 ^{o}F that the day's average temperature is.
    - This information can be obtained from state climatological offices, airport meteorology stations, or National Oceanographic and Atmospheric Administration (NOAA) climate data.

$$\text{Seasonal Fuel Consumption (Space Heating)} = \text{Annual Fuel Consumption For Space Heating} * \frac{\text{Number of Heating Degree Days in Season}}{\text{Total Heating Degree Days Annually}}$$

For example, if the heating degree days for an entire year in an inventory area are 2430, and the heating degree days for the inventory period (119 days) are 1800, then the apportioning factor for the inventory area is:

$$0.74 = \frac{\text{1800 inventory period heating degree days}}{\text{2430 annual heating degree days}}$$

A seasonal activity factor of 0.43 can be used for the 3 month winter wood-burning season, if other approaches are not possible (EPA, 1991).

Daily Resolution

Residential wood combustion is assumed to occur seven days a week during the heating season.

The Utah Administrative Code, R307-1-4.12.3 restricted the use of residential woodburning devices during the winter when the local meteorology indicated high, or potentially high, concentrations of airborne particulate (Attachment 4). A "green light" means that no woodburning restrictions are in effect, a "yellow light" means that voluntary restrictions are in effect, and a "red light" means that mandatory restrictions are in effect. The public is informed of the burn/no-burn condition during daily weather reports conducted by local television and radio stations and on the front page of the daily newspapers. During the winter of 1992/93, violations were curtailed after friendly warning from UDAQ staff. During the winter of 12993/94, warnings were more firm and citations were given to flagrant violators.

The PM10 SIP established a 60% Rule Effectiveness (RE) factor for these PM10-triggered "red" days in Davis, Salt Lake, and Utah Counties. In addition, the State recognized that emissions that woodburning emissions will be decreased on "yellow" days due to some voluntary emission reductions.

5.11.3 BAKERIES

Calculation of Annual Emissions

This category covers volatile organic compounds (VOC) emissions from yeast leavening of baked goods at commercial and retail bakeries. Large bakeries are inventoried as point sources. Emissions from bakeries due to fuel combustion are not included in this category. Yeast-leavened bakery products include bread, bread-type rolls, pretzels, and sweet yeast goods such as doughnuts. Ethanol is the primary VOC emitted from the yeast leavening of baked goods. Baked goods that are chemically leavened with baking powder instead of yeast do not produce VOC and are not included in this source category.

There are two basic types of yeast dough mixing processes used in bakeries: sponge-dough and straight-dough. For the purpose of estimating emissions, the length of the fermentation time is the critical difference between these two processes. It is during the fermentation process that the VOC are produced. The sponge dough process, which is most commonly used by commercial bakeries, produces the largest amount of VOC emissions because the required fermentation time can be five hours or more. The straight dough process is primarily used by retail bakeries and has a much lower VOC emissions than the sponge dough process.

Volume III of the EIIP Area Source Category Method Abstract-Bakeries includes an alternative method of estimating bakery emissions using per capita consumption factor. This is the method that will be used for the PM10 SIP inventory. The human population estimates were obtained from the Utah Governor's Office of Planning and Budget. The emission factor of 0.155 tons VOC per capita was obtained from a memorandum from the Inventory Guidance and Evaluation Section dated April 24, 1992.

Population will be reduced to compensate for bread products produced by the two point source bakeries and sold within counties within the domain.

(population) x (0.155 tons VOC/yr / 1,000 people) = VOC tons/yr.

Calculation of typical ozone day emissions

Bakeries were assumed to operate uniformly, 6 days per week, 52 weeks per year.

(VOC tons/yr) / (312 days/yr) = VOC tons/day

5.11.4 RESIDENTIAL AND COMMERCIAL / INSTITUTIONAL COAL COMBUSTION

Calculation of Annual Emissions

This source category covers air emissions from coal combustion in the residential and commercial sectors for space heating or water heating. This category includes small boilers, furnaces, heaters, and other heating units that are not inventoried as point sources. Residential and commercial coal combustion sectors comprise housing units; wholesale and retail businesses; health institutions; social and educational institutions; and Federal, state, and local government institutions (e.g., military installations, prisons, office buildings).

UDAQ will be using EPA's recommended method as described in Volume III, "Area Source Category Method Abstract- Coal Combustion" dated 4-6-1999 in the EIIP. This method is described below.

The preferred source for coal consumption information is the state energy office. If an assumption is required to separate residential and commercial consumption, the following resources may be used:

- Contact a small number of local distributors to obtain estimates for the residential and commercial portions of deliveries; or
- The U.S. Census Bureau reports the number of households at state and county[1] levels that use coal as their primary space heating fuel. Household data are available from the 1990 census.

If very few households use coal, then coal deliveries can be assumed to be entirely to the commercial sector.

An alternative source of activity data is the Department of Energy (DOE) Energy Information Administration (EIA) document *State Energy Data Report*. The *State Energy Data Report* is[2] based on an EIA survey of all U.S. companies that own or purchase and distribute more than 50,000 short tons of coal annually. EIA does not collect the information necessary to separate coal combustion into residential and commercial/institutional consumption, but disaggregates data based on assumptions and statistical methods detailed in the *State Energy Data Report*. The assumptions used by EIA to disaggregate the data are applicable to the national level and may not be correct for the inventory area. To separate *State Energy Data Report* information into residential and commercial/institutional consumption, the following resources may be used:

- Use the EIA data as reported;
- Contact a small number of local distributors to obtain estimates for the residential and commercial portions of deliveries; or
- The U.S. Census Bureau reports the number of households at state and county levels that use coal as their primary space heating fuel. Household data are available from the 1990 census.

If very few households use coal, then coal deliveries can be assumed to be entirely to the commercial sector.

Emission factors are available from *AP-42*, Chapter 1: External Combustion Sources; Section 1.1 for bituminous and subbituminous coals; and Section 1.2 for anthracite coal (EPA, 1998a). For residential sources, the emission factor for residential space heaters should be used for anthracite coals and the emission factor for hand-fed units should be used for bituminous and subbituminous coals. For commercial sources, the combustion method varies greatly within an inventory area; therefore, it is difficult to determine the predominant combustion method.

A portion of the activity data may represent deliveries to larger commercial, institutional, or multi-family facilities that may be inventoried as point individual sources. Estimated area source activity or emissions should be adjusted by subtracting the activity or emissions attributable to point sources. It is preferable to use activity data when making point source adjustments because emission estimates are not easily comparable due to differences in emission estimation methods or emission factors. If only emissions are available, then it is preferable to subtract pre-control emission estimates for point sources. Regulations for coal combustion are generally applicable to point sources and do not apply to the area sources in this category. Inventory preparers should research rules applying to this source category.

Calculation of typical winter-day emissions

Inventory preparers should develop a preliminary state-wide estimate of emissions from this source and then decide if emission levels justify the effort required to collect data for spatial and temporal apportioning. If this category is not expected to be a significant contributor during the inventory time period, then apportioning methods that require less effort may be used.

The preferable method to spatially allocate residential emissions to the county level is to allocate fuel use based on the number of households heating with coal and the number of heating degree days.

A "heating degree day" is a unit of measure used to indicate how cold it has been over a 24-hour period. Daily heating degree days are calculated as the difference between the base value of 65°F and the mean temperature for the day (mean of the high and low temperatures for the day). Annual heating degree days are the sum of the daily heating degree days. Heating degree data is available from the National Oceanographic and Atmospheric Administration (NOAA).

The residential spatial apportioning factor is found in Volume III, "Area Source Category Method Abstract - Coal Combustion" of EIIP. Alternative spatial apportioning factors for residential emissions include households that use coal as a primary fuel, population data, or total number of households.

Commercial/institutional coal combustion emissions may be apportioned based on employment data for SICs 50-99 and heating degree days. Employment information may be obtained from the state department of labor or from Economic Census data from the U.S. Census Bureau.

The commercial/institutional spatial apportioning factor is found in the above document. Alternative methods to spatially apportion emissions from commercial/institutional sources are to use either employment data or population data as allocation factors.

Residential coal combustion is primarily used for space heating purposes. Space heating consumption may be seasonally apportioned using the percentage of annual heating degree days occurring in each month or season. For each episode day in the UDAQ study period, the equation is:

$$\underline{\text{Heating Degree Days}_{day}}$$

$$\text{Residential Fuel}_{day} = \text{Residential Fuel}_{annual} * \text{Heating Degree Days}_{annual}$$

Commercial use may be temporally apportioned based on information from local distributors. Monthly deliveries should be obtained from a small sample of commercial/institutional coal distributors. The monthly percentages of annual deliveries found for the sampled distributors may be used to apportion consumption for the inventory area.

5.11.5 NATURAL GAS

Calculation of Annual Emissions

Statewide natural gas consumption data was supplied by Questar Corporation allowing UDAQ to utilize EPA's Preferred Method discussed in Volume III *Residential and Commercial/Institution Natural Gas and Liquefied Petroleum Gas (LPG) Combustion* section of the EIIP. The data consisted of county-wide, annual consumption in millions of Btu for general service gas customers (GSDTH) and major gas customers (NONGSDTH). It was assumed that all industrial natural gas consumption was included in the point source inventory. The industrial consumption, from the point source inventory, was subtracted from the NONGSDTH numbers, and the remainder was assumed to be consumed by commercial/institutional sources.

The first step is to convert the fuel consumption from MMBtu to MMCF. In a letter dated February 2, 2000, Questar Corporation stated that their gas averages 1,055 Btu per cubic foot.

(MMBtu) / (1,055 Btu/CF) = MMCF

Emission factors from Tables 1.4-1 and 1.4-3 of the AP-42 were used to calculate natural gas combustion emissions for domestic and commercial boilers.

(emission factor, lbs/MMCF) x (fuel consumption) x (1 ton/2000 lb) = emissions in ton/year.

Calculation of Typical Winter-Day Emissions

Questar Corporation supplied information pertaining to the amount (by percentage) of fuel typically consumed in the winter months (Nov., Dec., and Jan.) and the amount consumed in the summer months (June, July and Aug.). There were 119 days in the PM10 (winter) season.

Emissions (tons/yr) x (percentage winter fuel use) / (119 days) = emissions (tons/day).

5.11.6 FUEL OIL AND KEROSENE COMBUSTION (Previously named Oil Combustion)

<u>Calculation of Annual Emissions</u>

The Utah Energy Statistical Abstract documents the amount of fuel oil consumed by residential sources, commercial sources, and industrial sources in the state of Utah. It was assumed that the consumption of oil along the Wasatch Front as compared to consumption of fuel oil in the rest of the state was 1 to 10. First a consumption factor was calculated, using the 1 to 10 ratio described above. Population estimates were obtained from the Utah Office of Planning and Budget. The amount of fuel oil consumed was then determined by multiplying the consumption factor by the population of the given county or city. The fuel oil consumed by industrial sources and accounted for in the point source inventory was subtracted from the industrial fuel oil consumption for industrial area sources.

For example:

OCW = Oil consumed/person in the 4 Wasatch Front Counties
OCNW = Oil consumed/person in the rest of the state
OC = total oil consumed/year in Utah
WP = Wasatch Front population
NWP = Population in the rest of the state

$$(OCW \times WP) + (OCNW \times NWP) = OC$$

and

$$(50) \times (OCW) = OCNW$$

Therefore:

$$OCW = OC / (WP + (50 \times NWP))$$

The fuel oil consumed in each non-attainment area is calculated as follows:

Oil consumed in Davis County = OCW x (population of Davis County).

Using these numbers and the emission factors in AP-42, in table 1.3-2 (Attachment 3), the emissions were calculated.

(EF, lbs/ton) x (OC tons/yr) x (1 ton/2,000 lb) = emissions in ton/year.

EF = Emission Factor
OC = Fuel Consumption

Calculation of typical winter-day emissions

It was assumed that the percent of fuel oil combustion in the ozone season was identical to that of natural gas use, which has been provided by Questar Corporation. There were 119 days in the winter season.

(VOC tons/yr) x (%NG use in winter) / (119 days/winter season) = VOC tons/day.

5.11.7 BREWERIES, WINERIES, DISTILLERIES

Telephone survey with the state's two largest breweries led to very low emissions estimate. The facilities are considered to be micro breweries. The emissions are negligible based on the amount of beer produced in these facilities. This category is not included in EIIP.

5.11.8 CATASTROPHIC/ACCIDENTAL RELEASES

There were no catastrophic/accidental releases in the PM10 domain during 1996. Therefore, emissions during the ozone season are estimated at zero.

5.11.9 SYNTHETIC ORGANIC CHEMICAL STORAGE TANKS (SOCST)

No data has been found that this type of material is stored in Utah. Therefore, the emissions are zero for this category.

5.12 SOLID WASTE INCINERATION AND OPEN BURNING

5.12.1 INCINERATION

Volume III, Area Sources Preferred and Alternative Methods of EIIP does not include incineration. New Source Performance Standards have been developed for incineration sources, and therefore, they are included as point sources. UDAQ will not include this category in the 1996 PM10 episode inventory under air source listings.

5.12.2 FOREST FIRES

Calculation of annual emissions

Forest fire data was collected by the Utah Division of State Lands and Forestry. They compile data for total acres burned per county on public and private lands (by county) excepting private house and field fires inside metro area. Emission factors for forest and range fires for the Intermountain Region, Region 4, were obtained from AP-42. These factors are based on an average fuel loading of 40 Mg/hectare in this region.

First, the emission factors are converted to English units.

$$(\text{EF, kg/hectare}) \times (1.1023 \times 10^{-3} \text{ tons/kg}) / (2.471 \text{ acres/hectare}) = \text{EF tons/acre.}$$

Then the emission factors are multiplied by the number of acres burned to obtain the annual emissions for each county.

$$(\text{EF, tons/acre}) \times (\text{acres burned/yr}) = \text{emissions tons/yr.}$$

Calculation of typical winter-day emissions

Forest fires occur primarily during the summer months. The fire season typically lasts 184 days/year according to USFS, Intermountain Regional office staff. (Same length accepted in past years.) After reviewing information supplied by Utah Division of State Lands and Forestry, the accepted clearing house for forest and range burning, it was determined that there were no forest fires in the domain during 1996 winter season.

5.12.3 FIREFIGHTING TRAINING

Telephone surveys in 1991, and repeated in year 2000, confirm that fire training activities occur primarily in simulators with theatrical smoke. Actual fire training events are random and rare. UDAQ assumes that emissions are negligible.

5.12.4 Structure Fires

Calculation of annual emissions

Structural fires are estimated by Alternative Method 2 outlined in Volume III, Chapter 18 of EIIP. This method calculates the emissions by multiplying human population (by county) by national-default emission factors. In the absence of local trends, national average conditions will be projected onto our domain: Six fires per 1000 residents and 1.15 tons of material burned per average fire. Emission factors for VOC, NOx, and PM are included in this EPA guidance document. These factors are multiplied by the population of each city or county to obtain the annual emissions of VOC, NOx and PM. Population numbers were obtained from the Utah Governor's Office of Planning and Budget.

(population)(6 fires/1000 people)(1.15 tons material/fire)(EF, lbs/ton material) = emissions tons/yr.

Calculation of typical ozone day emissions

This guidance document suggests assuming an equal distribution of structural fires throughout the year with a seven-day activity week.

(emissions tons/yr) / (365 days/yr) = tons/day.

5.12.5 PRESCRIBED BURNING/SLASH BURNING/AGRICULTURAL BURNING

Calculation of annual emissions

Annual emissions for both slash and prescribed burning are estimated as zero. Any slash or prescribed burning by the Forest Service is accounted for in the Forest Fire section of this inventory.

Annual emissions for agricultural burning are very difficult to estimate. Richard Harvey, Director of Davis County Environmental Health & Laboratory Division, estimated that 1/3 of the planted acres in this area are burned. The number of harvested acres, per county, was obtained from the Utah Department of Agriculture. A fuel loading factor of 2 tons per acre was obtained from AP-42, Section 2.5 Open Burning, Table 2.5-5.

(harvested acres) x (1/3) x (2 tons/acre) = tons of material burned.

Emission factors from AP-42, Table 2.5-5 for PM, and VOC will be used. These emission factors will be multiplied by the tons of material burned to obtain annual emissions.

(tons of material burned) x (EF lbs/ton) x (1 ton/2000 lbs) = emissions tons/yr.

A population comparison was done in the 1990 base year inventory to see if the calculated emissions seemed feasible.

Calculation of typical winter-day emissions

UDAQ will research the dates of agricultural crop burn-off in the domain area to determine emissions during the winter season.

5.12.6 OPEN BURNING

According to State of Utah, Utah Air Conservation Rules, R307-202-5(3)(e)(I), open burning is not allowed without a permit. Permits are only issued during a 30-day period between March 30 and May 30, thereby prohibiting emissions during the winter months. Therefore, open burning emissions are not included in the PM10 SIP inventory.

Previously detonation was included in this category. EIIP does not include it as an area source. Companies that do detonation are included in the point source inventory.

5.12.7 AIRCRAFT/ROCKET ENGINE FIRING AND TESTING

Calculation of annual emissions

1. Rocket testing

No rocket testing occurs within the nonattainment area that has not otherwise been accounted for under the point source inventory.

2. Aircraft testing, tuning, and repair

A UDAQ 1991 telephone survey of eight airplane maintenance agencies indicated that maintenance procedures emit approximately 0.7% to 1% of the emissions of landing/take off (LTO) events. In other words, we estimated emissions from LTO and estimated an additional 1% to account for maintenance.

The following paragraphs show how the 1% figure was determined, using data from the 1990 inventory

(LTO emissions in tons/yr) x (1%) = aircraft maintenance emissions tons/yr

Justification for 1% Emission Factor

Periodically, aircraft engines must be tuned to minimize engine wear and maintain flight safety. Large airlines have their own teams of resident mechanics while small fleet and individual plane owners hire the services for an FBO (fixed base operator) for repair services. These FBOs conduct business similar to a typical automobile repair shop. Fees are set by the hour of repair time or by the category of a particular repair service. Records of moderate detail are kept by airlines of the maintenance history of each plane within their fleet, but individual FBOs do not keep such records on the many individually-owned planes brought to them for service. Private owners may or may not keep a log of their repair history. Furthermore, collecting details of one-by-one repair histories would be difficult to determine. For these reasons, a link between total takeoff and landing data (LTO cycles) and aircraft maintenance trends will be established. Airline and FBOs were interviewed to establish this link.

Within Salt Lake County, the following airplane maintenance agencies were found:

Delta Airlines	578-2650, 578-2653;
Utah National Guard	595-2200;
Skywest	575-2650;
Morris Air	575-2599;
Salt Lake Jet Center	595-6438;
Million Air	359-2085;
Hudson General	539-2805,

Magestic Air Service 539-0612.

Among these agencies, UDAQ conducted four surveys by mail and two interviews by telephone to understand the breadth of repair activities. These correspondence revealed that emissions will only occur during idling and flight simulation tests, commonly called *engine-run tests.* Agencies completing the mail-in surveys identified the number of engine-run tests and the number of minutes of each test.

The following data sources were used to refine the emissions estimate. Most references are drawn from the same sources used to estimate LTO emissions in Section 3.2.1 of the 1990 Salt Lake/Davis County Ozone inventory.

1.) Wasatch Front Regional Council records showing total aircraft operations at SLCIA in 1990 to be 303,352. (Section 3.2.1, Attachment 4 of the 1990 Inventory)

2.) Delta airlines statistics declaring average time to taxi-in and taxi-out to be 14.5 and 4.9 minutes respectively. (Section 3.2.1, Attachment 2 of the 1990 Inventory)

3.) SLCIA records showing total monthly flight activity to be nearly stable year-round (Section 3.2.1, Attachment 3 of the 1990 Inventory)

4.) Survey questionnaire completed by Delta Airlines (Section 2.12.7, Attachment 1 of the 1990 Inventory).

Delta Airlines responded to question #3 of the survey questionnaire by declaring the number of engine-running tests completed in 1990 and the length of time (expressed as a range) of the tests. Delta's responses were as follows:

700 tests	1 to 5 minutes
700 tests	5 to 10 minutes
300 tests	10 to 20 minutes
100 tests	20 to 30 minutes
no tests exceeding 30 minutes	

Taking the upper end of each range results in a conservatively high estimate of engine-run testing time. This will lead to a conservatively high tonnage of emissions.

(700) (5 minutes) =	3,500 minutes
(700) (10 minutes) =	7,000 minutes
(300) (20 minutes) =	6,000 minutes
(100) (30 minutes) =	<u>3,000 minutes</u>
	19,500 minutes of engine-run time

Delta declared in their January 21, 1993 submittal that taxi-in and taxi-out times are 14.5 and 4.9 minutes respectively. Adding 4 additional minutes for idling, descend and climb-out times, sums to a total of 23.4 minutes. (All these phases comprise a complete LTO cycle.)

In their publication entitled "Salt Lake Metropolitan Airports System Plan", the WFRC stated Delta Airlines operates approximately 80% of the jet carrier flights operating from the SLCIA airport. Since Delta is estimated to run 19,500 minutes of maintenance testing, 24,375 minutes of testing will account for the entire SLCIA; (19,500 minutes / 0.80). Since each LTO cycle requires 23.4 minutes of engine running, 24,375 minutes of testing is equivalent to 1,042 LTOs (24,375 minutes / 23.4 minutes). [We are assuming that the emissions per minute are similar during a minute of testing versus a minute of LTO.] Thus, 0.7% additional emissions can be attributed to the SLCIA due to aircraft engine maintenance (1,042 equivalent LTOs / 151,676 actual LTOs = 0.0068 or .7%). It does not seem unreasonable to apply this 0.7% factor to all airport activity within the NAA.

If this process were repeated for small private or military planes, maintenance trends may differ from the 0.7% estimated above. These other plane groupings may increase or decrease the 0.7% estimate. Acknowledging that the emissions from aircraft maintenance is relatively small, a decision was made to simplify this category as much as possible and apply a constant 1% to all LTOs at all airports throughout the NAA including Hill Air Force Base.

Calculation of typical winter-day emissions

Daily emissions for airport LTOs are calculated in the non-road portion of this inventory. The same 1% factor is applied to the daily emissions from LTOs to determine the daily emissions from aircraft maintenance.

(LTO emissions in tons/day) x (1%) = aircraft maintenance emissions tons/day.

5.12.8 CHARCOAL GRILLING

In 1993, this category was believed to be negligible, prompting EPA Region VIII to issue their 8/19/1993 letter saying that "...charcoal grilling emissions do not have to be addressed by the State at this time." Therefore, they were not calculated in 1996.

5.12.9 VEHICLE FIRES

Calculation of annual emissions

This category covers air emissions from accidental vehicle fires. Vehicles included are any commercial or private mode of transportation that is authorized for use on public roads.

The number of vehicle fires will be requested from state and local fire marshals and the public safety departments. If the information is not available for 1996, the national estimate of vehicle fires from *Fire in the United States* (FEMA, 1997) (available from the Federal Emergency Management Agency *http://www.usfa.fema.gov/nfp/data/fius9th.htm*) will be used. The national total of transportation fires reported in the FEMA report must be corrected by subtracting the number of non-roadway fires reported such as rail, water, and air transportation fires. In 1994 the respective percentages of fires reported for these non-roadway transportation modes were 0.2, 0.5, and 0.1 (i.e., 99.2% of the fires were highway vehicle fires). Highway vehicle fires in 1994 are estimated to be 402,000 fires. The national estimate would be apportioned to the local level using state vehicle miles traveled (VMT).

AP42, Section 2.5, Open Burning, would be the source of emission factors. These factors cover automobile components including upholstery, belts, hoses, and tires. The amount of vehicle material burned (the fuel loading) in a vehicle fire must be estimated to use these factors. A conservative assumption is that an average vehicle has 500 pounds of components that can burn in a fire, based on a 3,700 pound average vehicle weight (CARB, 1995).

The emission factors (EPA 1996) are as follows:

Pollutant	**Lbs/ton burned**
PM	100
CO	125
Methane	10
Nonmethane TOC	32
NOx	4

Calculation of typical winter-day emissions

The emissions from this category will be spatially apportioned using one of the following methods. Vehicle miles traveled may be used to spatially apportion national fire activity to the state level. The Federal Highway Administration provides state level vehicle miles traveled (*http://www.fhwa.dot.gov/ohim/ohimstat.htm*). To apportion to the local level, local vehicle miles traveled may be obtained from the state department of transportation. Alternately, state level data may be apportioned to local areas based on vehicle registration information obtained from the state department of motor vehicles. Other surrogates such as population or roadway miles may be used to apportion the number of fires to the local level.

5.13 BARGE, TANK, TANK TRUCK, RAIL CAR AND DRUM CLEANING

5.13.1 BARGE CLEANING

No barges are used to transport materials on any of Utah's small rivers or the Great Salt Lake. The estimated VOC emissions from this process is zero.

5.13.2 CHEMICAL TANK EMISSIONS

Various tank emissions are included as portions of all three inventory headings; the Point, Area, and Mobile source headings. Because these emissions are already accounted for in the rest of the inventory, this section is a negative declaration. In review, the following storage tanks are covered under the following inventory sections:

Point Source Inventory

VOC losses from on-site petroleum tanks at all fuel refineries within the NAA.

VOC losses from on-site containers of fuels, solvents, and coatings used or consumed by point sources covering the industries listed in the point source inventory report.

Area Source Inventory

VOC losses from the distribution of fuel to gas stations within the NAA. Area source accountability includes fuel loading at bulk terminals, tank trucks in transit, tank trucks during unloading at gas stations, service station breathing losses, and refueling of private vehicles. Estimates are based on gallons of fuel distributed.

VOC losses from the storage of solvents used for parts degreasing.

VOC losses from the use of solvents assisting the printing and graphics industries.

VOC losses from the storage of cutback and emulsifiers for asphalt production and application.

VOC losses from tanks at drycleaning operations.

VOC losses from the storage of miscellaneous commercial/consumer solvents.

Mobile Source Inventory

Evaporative VOC losses from the fuel tanks of individual motor vehicles after leaving the gas station. Estimates are based on MOBILE5A factors (grams/gallon) and gross gallons of fuel distributed.

5.13.3 EMISSIONS FROM TANK TRUCK CLEANING

Calculation of annual emissions

Emissions of 0.11 tons per year (tpy) for Salt Lake County, and 0.03 tpy for Davis County were calculated for this category in the 1990 inventory. Because the emissions were low, the calculations have not been repeated, and emissions from this category are presumed to continue to remain low both annually and season days.

1990 Base Year Inventory Calculations - Showing Negligible Emissions
Bruce Holmes, hazardous materials expert with the Federal Highway Administration Department of Motor Carriers, was interviewed by UDAQ about tank truck cleaning in the Ozone NAA. In the absence of industry records, Bruce had a broad-based knowledge of the chemical fleet size and truck cleaning trends in the area. The following data was received from Bruce and utilized for the appropriate calculations:

1) There are 1100 cargo tanks operating in the Salt Lake and Davis County area.

2) Of the 1100 tanks, approximately 400 are cleaned and purged annually in the combined Salt Lake and Davis area.

3) These totals represent those cargo trucks which permanently operate in the Salt Lake and Davis County areas.

4) The above values represent 1992 activity. Since pure 1990 data could not be found, the State felt that for the information listed above could be considered to be representative of 1990 data and could be used for the base year inventory.

EMISSION FACTORS FOR CHEMICALS

The following factors are directly from AP-42, Table 4.8-2 and will be used in the calculations to cover the transported chemicals:

COMPOUND	TOTAL EMISSIONS
Acetone	0.686 lbs/truck
Perchloroethylene	0.474 lbs/truck
Methyl Methacrylate	0.071 lbs/truck
Phenol	0.012 lbs/truck
Propylene Glycol	0.002 lbs/truck

Of the five chemicals stated above, UDAQ's best sources did not know an approximate frequency of cleaning any specific chemical residual from these 400 truck tanks annually. Nor could the source tell us the fraction of the 400 tanks cleaned of petroleum residuals. The source could only identify that 400 tank trucks were cleaned of some chemical or petroleum product annually. Left with this sketchy information, a worst-case situation was assumed. Every tank was assumed to have VOC losses equal with acetone; the most volatile of the five chemicals. Other sections of the AP42 were reviewed for evidence of a reasonable emission factor (in VOC losses/truck cleaned) for gasoline. No factor was found for gasoline; therefore, the emission factor for acetone was used for the worst-case scenario.

Calculations are as follows:

Entire NAA: (400 trucks cleaned annually) x (0.686 lbs / truck) = 274 lbs VOC losses per year for the entire ozone area.

Since this loss is small, it will be acceptable to use county populations to divide the loss between counties.

The population of Salt Lake County for 1990 = 725,956

The population of Davis County for 1990 = 187,941

SALT LAKE COUNTY:

Salt Lake fraction = 725,956 / (187,941 + 725,956) = 0.79 or 79% of the NAA population lives in Salt Lake County.

(0.79) x (274 lbs VOC annually) = 218.0 lbs VOC losses = 0.11 tons of VOC released per year in Salt Lake County.

DAVIS COUNTY:

Davis fraction = 187,941 / (187,941 + 725,956) = 0.21 or 21% of the NAA population resides in Davis County.

(0.21) x (274 lbs VOC annually) = 56.4 lbs VOC losses = 0.03 tons of VOC released per year in Davis County.

Due to the low emissions and population, no calculations will be preformed for other areas in the domain.

5.13.4 RAILCAR CLEANING

Calculation of annual emissions

The 1990 inventory included a negative declaration for this category. The justification for concluding that no, or negligible, emissions were released in 1990 is summarized below. We draw upon the same conclusions to report no emissions in 1996.

During the course of the 1990 investigation, it became apparent that calculating emissions from the cleaning of railcar and tank truck would be more difficult than the UDAQ first assumed. Here is a brief synopsis of the research that has been performed in regards to railcar and tank truck cleaning, and the difficulties which have made it impossible to calculate emissions from this category.

All of the class I and II railroads in Salt Lake and Davis Counties were contacted to ascertain the following information:

1) The number of railcar tanks that were cleaned during 1990;
2) The types of liquid compounds transported during 1990; and
3) Whether or not the railroad had their own facilities in these counties that performed railcar cleaning during that period and, if not, what companies, if any, they contracted to perform the work.

Dave Hussman of Union Pacific offered information on cleaning which led to the first dead end. He stated that railroad tank cars are not owned or maintained by the individual railroad companies in the area. Each railroad company may own and operate a few individual tank cars of their own; however, these cars are used only for hauling diesel or water and are specifically dedicated to these uses. Tank cars are either owned by the product manufacturer themselves or by tank car companies. These tanks are cleaned by "car repair companies" and not by the individual owners or operators themselves. None of the railroad officials contacted knew if there were any of these car repair companies operating in Utah.

One official referred the State to the *American Association of Railroads* in Washington, D.C. This contact informed us of a publication called "The Pocket List of Railroad Officials," which is a directory of railroad suppliers of products and services in the United States. This book is apparently set up much like a telephone directory and could be used to determine whether there are any car repair companies conducting business in Utah. When contacted, it was found that none of the railroads in the area owned this book or used it as a common reference. Neither is the book available at the University of Utah library. University staff suggested that we could call 1-800-221-5488 to order a copy. Since the State has no use for this book beyond the inventory, and due to the fact that the edition available for purchase was not the current year, the State felt that purchasing this book would not be judicious.

Instead, the metropolitan Salt Lake telephone directory (yellow pages) were researched to glean any information on railcar repair companies in the area. Two of these companies were contacted for help in locating the book mentioned earlier and for any information about railcar repair or cleaning. Three leads surfaced. These three companies were contacted:

1) Castleberry Railroad Maintenance and Construction - Mr. Castleberry told me that he had a copy of the railroad directory, but that it was a 1978 version. He also informed me that he had no knowledge of any companies in Utah that cleaned railcar tanks. He knew of a few in Wyoming, but not in this location.

2) A&K Railroad Materials - This company had neither the directory nor any knowledge of this type of company in the state of Utah.

3.) The Utah Railway Company (URC) was contacted along with numerous other railway maintenance and repair companies throughout the United States. Mr. Gil Son of URC reported that he knew of a company in Ogden City that cleaned hopper cars containing coal and other dried materials, but was unaware of any companies in Utah that were responsible for any kind of liquid cleaning that would create VOC emissions.

Based on the research completed for this category, it is the State's conjecture that railcar cleaning companies in the Salt Lake or Davis County areas are nominal or nonexistent and, therefore, any emissions from this type of cleaning process are reported to be zero.

5.13.5 DRUM CLEANING

Calculation of annual emissions

Total 1990 emissions of 86 pounds per year of NO_x and zero emissions of VOC were released into the airshed for this category. Because the emissions were so low, the calculations have not been repeated for 1996, and emissions from this category are assumed to be negligible for annual emissions and typical winter day emissions.

1990 Base Year Inventory Calculations - Showing Negligible Emissions
The level II checklist as detailed on page A-19 of the "Quality Review Guidelines for 1990 Base Year Emission Inventory" EPA 450/4-91-022, September 1991, requires estimates for VOC and NO_x emissions derived from drum cleaning operations.

To obtain information about the number and name of drum cleaning facilities in the ozone nonattainment area the following procedures were followed:

(a) the Division's case files were reviewed,

(b) Don Verbica, manager, Compliance Section with the Division of Solid and Hazardous Waste was interviewed, and

(c) the telephone books for Davis and Salt Lake County were reviewed.

No approval orders were issued by the Division of Air Quality for drum cleaning facilities in the nonattainment area; however, Myer Container has been inspected by compliance inspectors due to public complaints. Don Verbica with the Division of Solid and Hazardous Waste supplied additional names of Beehive Barrel and Allstate Container. The telephone book survey revealed only one additional company in the nonattainment area, Utah Barrel.

Each of the companies were contacted with the following results:

(a) Beehive Barrel (801) 973-8322, Richard Hooper, Plant Manager
The number of drums cleaned in 1990: Approximately 800 drums per month.
Method Of Cleaning: The company only uses caustic soda to clean the drums.
Waste Stream Management: Drum cleaning is performed in a totally enclosed system. The used caustic soda is cleaned and recycled and the waste stream, comprised of various contaminants, is diverted to a totally enclosed underground storage tank. Envirochem Incorporated of Orem, Utah comes monthly and pumps out the tank. Envirochem transports the waste to Texas where it is incinerated.
Major Supplier of Used Drums: petroleum companies and food stores.

(b) Allstate Container (801) 561-9714, Karen Jones, assistant
The number of Drums Cleaned in 1990: 3,000 to 4,000 drums per month.
Method Of Cleaning: The company only uses caustic soda to clean the drums.
Waste Stream Management: They adhere to EPA's "10 drip rule". If more than 10 drips of material are present in the bottom of the drum or drums they will not accept the drum for cleaning. They do not want the liability. The cleaning of drums is performed in a totally enclosed system. The used caustic soda is cleaned and recycled and the waste stream comprised of various contaminates is diverted to a totally enclosed underground storage tank. Advanced Petroleum Recycling, Inc of West Valley City comes by when necessary and pumps out the tank. They do not know what Advanced Petroleum Recycling Inc does with the waste stream but assumes it is incinerated somewhere. Petroleum companies are major suppliers of used drums.

(c) Utah Barrel 363-1933, Sandy Pepper, manager.
This company only sells new or refurbished drums. They are a distributor and do not clean drums or barrels.

(d) Myer Container, (801) 322-3529, Bill Hjorten, manager.
Number Of Drums Cleaned in 1990: approximately 1,800 drums/month.

Method Of Cleaning: The company uses a steam wash and drum burning furnace to clean the drums.

(e)Waste Stream Management: The drums are first steam-cleaned and then conveyed through the furnace and finally are sand blasted to remove the blistered paint and any remaining residue. The material removed from the drums, due to steam cleaning, is collected through the grated floor in an underground storage tank. A surface tension skimmer pulls the waste off the top of the water into a separate storage tank. The water is recycled for steam production and the waste material is pumped out of the underground storage tank at irregular intervals depending on the level. Advanced Petroleum Recycling Inc pumps the waste stream material and transports it off site. The drum furnace runs on natural gas and has an afterburner that operates at a temperature of 1700 °F.
Major Supplier Of Used Drums: petroleum and chemical companies.

To estimate the amount of VOC and NO_x produced by these sources, the AP-42 was referred to and EPA's emission inventory guidance in Volume III: Area Sources. Based on the information provided in these references, "there are no controls for steam cleaning" and "solution or caustic washing yields negligible air emissions, because the drum is closed during the wash cycle". It is also assumed that there are negligible VOC emissions produced from the waste streams which empty directly into underground storage tanks and are emptied and transported off-site by recyclers. The only emission factors available are for the drum furnace at Myer Container. The AP-42 provides the following emission factors for weight of pollutant released per drum burned:

PM_{10} = 0.02646 lb/drum,
NO_x = 0.00004 lb/drum and
VOC = negligible.

<u>Calculation of typical winter-day emissions</u>

Therefore, the following calculation was performed to estimate NOx and PM10 for the PM10 episode day emission inventory:

PM10

(1,800 drums/month) x (12 months/year) = 21,600 drums burned/year.

(21,600 drums burned/year) x (0.02646 lb PM10 /drum burned) =571.54 lb PM10 /year.

Converted to tons: (571.54 lb PM10/year) x (1 ton/2000 lbs) = <u>0.29 tons PM10 /year</u>.

NOx

(21,600 drums burned/year) x (0.00004 lb NO_x /drum burned) =0.864 lb NO_x /year.

Converted to tons: (0.864000 lb NO_x /year) x (1 ton/2000 lbs) = <u>0.00043 tons NO_x /year</u>.

In summary, based on the above assumptions and calculations, drum cleaning facilities in the nonattainment area in 1990 produced approximately 0.29 tons PM10, 0.00043 tons of NO_x and negligible VOC.

6. MOBILE SOURCES

6.1 NON-ROAD MOBILE

6.1.1 AIRCRAFT

<u>Calculation of Annual Emissions</u>

The airports in Utah are divided into two categories, large airports which require a more detailed inventory, and general aviation airports which require a less detailed inventory. There are two large airports in Utah, the Salt Lake City International Airport (SLCIA), and Hill Air Force Base. The rest of the airports do not have a large number of flights per year, and are considered general aviation airports.

1. Large Airports

a. Salt Lake City International Airport

Aircraft at the Salt Lake City International Airport (SLCIA) are divided into five categories for the purpose of this inventory: (1) commercial carriers that are listed in the FAA Aircraft Engine Emissions Database (FAEED), (2) military aircraft that are listed in the FAEED, (3) other commercial carriers or military aircraft, (4) general aviation aircraft, and (5) air taxi aircraft.

I. Civilian Aircraft that are listed in the FAEED

The FAEED calculates emissions from aircraft based on the number of landing and takeoff cycles (LTO) that occur at the airport in a year. The annual number of departures for each type of commercial carrier, which corresponds to the number of LTO, was obtained from The Airport Activity Statistics of Certificated Route Air Carriers. If an aircraft type was not included in the database, a similar aircraft was used as a surrogate. The World Encyclopedia of Civil Aircraft and Jane's All the World's Aircraft were used to identify similar aircraft. If a similar aircraft was not identified, the emissions were calculated as described in section iii below. The average taxi in/taxi out time for Delta Airlines was used for all aircraft at the SLCIA.

The type of aircraft, the probable engine on each aircraft, and number of LTO for that engine type, and details about the taxi and idle times were entered into the database. Tim Gwynette, the Environmental Programs Coordinator at SLCIA, provided a cross-referencing index to associate aircraft names and their common abbreviations (Attachment 3). The software then calculated emissions of VOC, CO, and NOx for each type of aircraft.

ii. Military Aircraft that are listed in the FAEED

The total number of military aircraft operations at the SLCIA were obtained from the Steve Domino and/or his representative at CM2MHill. LTO cycles are determined by dividing the number of operations by two. Three types of military aircraft typically use the airport: Lockheed C-130, Boeing C-135B, and Lac Georgia C141B, however, the number of LTOs for each type of plane is not available. Each of the aircraft emissions were calculated using the FAEED assuming the entire LTO number for military aircraft applied to that aircraft. The total emissions were then divided by three to obtain the emissions from this category of aircraft.

iii. Other Commercial Carriers or Military Aircraft

Several types of aircraft that operate at the SLCIA are not included in the FAEED, and a similar aircraft could not be identified. The emissions from these aircraft were calculated separately, using the method outlined in "Procedures for Emission Inventory Preparation Volume IV: Mobile Sources," EPA-450/4-81-026d.

Information about the engine used on the aircraft was obtained from tables within Volume IV, including fuel flow, average time, and emission factors in four modes of operation: takeoff, climb out, approach, and taxi/idle. Aircraft manufacturers were contacted, as needed, to obtain additional information about the engines used in a particular aircraft. The taxi/idle default times were replaced by average taxi in/taxi out times for Delta Airlines at the SLCIA. The emissions for a particular pollutant in each mode were calculated using the following equation.

VOC (tons/yr) = time (minutes) * fuel flow (lbs/min)/1000 * (lb VOC/1000 lb fuel) x (# of engines/plane) * (# of LTO cycles/yr) * (1 ton/2000 lbs)

The emissions during all four modes were then added to obtain the total emissions, in tons/yr, for that type of engine.

iv. General Aviation Aircraft and Air Taxis

Smaller aircraft, without detailed information are categorized by the Wasatch Front Regional Council as general aviation aircraft and air taxis. Emissions from these aircraft are calculated using general aviation and air taxi emission factors from "Procedures for Emission Inventory Preparation Volume IV: Mobile Sources," EPA-450/4-81-026d.

VOC (tons/yr) = (# of LTO cycles) * (lb VOC/LTO cycle) * (1 ton/2000 lbs)

b. Hill Air Force Base

Aircraft at Hill Air Force Base (HAFB) are divided into four categories for the purpose of this inventory: (1) military aircraft that are listed in the FAEED, (2) military aircraft listed in EPA guidance, (3) other military aircraft, and (4) touch and go activities. Actual 1994 flight statistics were received from Hill AFB and utilized in these calculations.

I. Military Aircraft that are listed in the FAEED

The FAEED calculates emissions from specific types of aircraft based on the number of landing and takeoff cycles (LTOs) that occur at the airport in a year. The annual number of landing and takeoff cycles (LTOs) for each type of aircraft was obtained from Hill Air Force Base. If the type of aircraft was not included in the database, a similar aircraft was used as a surrogate. The World Encyclopedia of Civil Aircraft and Jane's All the World's Aircraft were used to identify similar aircraft. If a similar aircraft was not identified, the emissions were calculated as described in section ii below.

The type of aircraft and number of LTOs were entered into the database. The database then calculated emissions of VOC, CO, and NOx from each type of aircraft, and totaled the emissions for the category.

ii. Military Aircraft listed in EPA guidance

Several aircraft that operate at Hill Air Force Base are not included in the FAEED, and a similar aircraft could not be identified. The emissions from these aircraft were calculated separately, using the method outlined in "Procedures for Emission Inventory Preparation Volume IV: Mobile Sources," EPA-450/4-81-026d.

Information about the engine used on each type of aircraft was obtained from tables within Volume IV, including fuel flow, average time, and emission factors in four modes of operation: takeoff, climb out, approach, and taxi/idle. The emissions for a particular pollutant in each mode were calculated using the following equation.

VOC (tons/yr) = time (minutes) * fuel flow (lbs/min)/1000 * (lb VOC/1000 lb fuel) * (#

of engines/plane) * (# of LTO cycles/yr) * (1 ton/2000 lbs)

The emissions during all four modes were then added to obtain the total emissions, in tons/yr, for that type of engine.

iii. Other Military Aircraft

There were several types of aircraft that were not addressed in the FAEED or in EPA guidance. In these cases, the emissions calculated by Hill Air Force Base in their annual emissions inventory were used.

iv. Touch and Go Activities

Touch and go operations at Hill Air Force Base could not be calculated using the FAEED model or by using the Volume IV guidance. For these operations, the emissions calculated by Hill Air Force Base in their annual emissions inventory were assumed to be accurate. This approach was approved by Tim Russ, EPA Region VIII, in a letter dated June 2, 1993.

2. General Aviation Airports

Most of the airports in Utah are small, local airports. Detailed information about the types of planes, and the number of flights for different planes is not available. Because detailed information is not available, the fleet average procedures outlined in "Procedures for Emission Inventory Preparation Volume IV: Mobile Sources," EPA-450/4-81-026d were used to calculate emissions. The number of operations at each airport per year was supplied by the Wasatch Front Regional Council. The number of landing and takeoff cycles (LTOs) was calculated by dividing the number of operations by two. Emissions from these flights were calculated using the general aviation emission factors from Volume IV.

VOC (tons/yr) = (# of LTO cycles) * (lb VOC/LTO cycle) * (1 ton/2000 lbs)

Calculation of typical winter-day emissions

Operational data were obtained from either the Wasatch Front Regional Council, or the specific airport to determine the activity level during the winter season. For small airports where data are not readily available, it was assumed that 15% of annual activity occurred during the winter season because local airports would be used more heavily during summer than the winter. Seasonal emissions were calculated by multiplying the annual emissions by the percent of activity during the winter season. Because there are 119 days in the winter season, the seasonal emissions were divided by 119 to obtain typical CO winter day emissions.

PM10 tons/day = (PM10 tons/yr) * (% activity during winter PM10 season) / 119

6.1.2 RAILROAD LOCOMOTIVES

The actual railroad diesel consumption by county is multiplied by national-default emission factors to calculate these emissions. Each rail company reported their own activity and diesel use. Emissions are not included in counties that do not have rail lines. No seasonal differences are noted.

Calculation of Annual Emissions

1. Line Haul Emissions

Two railroad companies were operating in Salt Lake and Davis Counties during 1996; Southern Pacific Lines and Union Pacific Railroad. Each company consumed diesel fuel to drive their locomotives. Both reported their diesel consumption by county (attachments 1).

Emission factors were obtained from "Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources," EPA-450/4-81-026d, July 1989, page 204, table 6-1.

(diesel consumption, gal/year) x (EF, lb/gal) / (2000 lb/ton) = emissions, tons/yr.

2. Yard Emissions:

These two railroad companies provided information about the number of yard engines that were operating in the area. The number of engines was averaged between days of the week and different shifts to provide an average number of yard engines. Emission factors were obtained from Volume IV, pages 206-207, table 6-2.

(Number of yard engines) x (EF, lbs/engine/yr) / (2000 lb/ton) = emissions, tons/yr.

Calculation of typical winter-day emissions

Railroad emissions were assumed to be a uniform activity, 365 days/year.

(emissions tons/day) / (365 days /yr) = emissions tons/day

6.2.3 MISCELLANEOUS NON-ROAD EQUIPMENT

Emission estimates for non-road equipment in several U.S. communities, covering calendar year 1990, were prepared by *Energy and Environmental Analysis, Inc* (EEAI) of Arlington, Virginia, and declared in “Nonroad Engine Emission Inventories for CO and Ozone Non-Attainment Boundaries”. Provo/Orem metro area was among the 33 metro areas studied by EEAI for winter conditions. Since no other Utah communities were examined by EEAI, findings from Provo/Orem will be used as a surrogate for the entire domain.

The specific methodology applied by EEAI to calculate Provo/Orem emissions is described in Attachment 1. Attachment 2 contains three key pages of values summarizing emissions from the 79 equipment types in the Provo/Orem area. These same 79 equipment types will be assumed to exist in the domain. To avoid double counting, all emissions from point source non-road equipment will be subtracted out except for ones from three prominent point sources in the domain. These sources will not be subtracted out because they are unique to domain and no similar sources exist in Provo/Orem. These three point sources are (1) the Kennecott mine at Barney’s Canyon, (2) the Kennecott mine at Bingham Canyon, and (3) Hill Air Force Base.

UDAQ will map the 1990 study area on to the 1990 domain area, then grow the activity inside the domain from 1990 to 1996 using a combination of local employment and population statistics. Each of the 79 equipment types will be multiplied by the growth factor that best represents the employment-sector controlling that equipment. (i.e., 1996 employment / 1990 employment). For example, annual changes in emissions from cranes and bulldozers will be linked to annual changes in local construction employment (number of construction jobs) while the annual changes in emissions from farm tractors will be linked to annual changes in agricultural employment. The same rational will be applied to each of the 79 equipment types. Ten employment sectors are available for use. With some of the equipment types, human population replaces employment as the best indicator of annual change. For example, general lawnmower emissions will be tracked with general human population under the rationale that each residence has a lawn that needs mowing. As the number of residences increase, the number of lawnmowers increase proportionally. The process will be repeated for each of the 79 equipment types.

7. POINT SOURCE EMISSION DATA

The 1996 statewide annual emissions inventory for point sources will be used to derive the modeling domain inventory. The point source data was extracted by county and then filtered by UTM data to determine which inventoried sources are within the modeling domain (Attachment 3). These sources include the major and Title V sources, sources with 10 tons/year of VOC in Salt Lake and Davis Counties, sources with 25 tons/year of NO_x in Utah, Salt Lake, and Davis Counties, and sources with 25 tons/year of SO_x and PM_{10} in Salt Lake and Utah Counties.

Average daily emissions of SO_x, NO_x, PM_{10} and VOC during the first quarter of the year will be calculated using available quarterly production data and days/week operating data. These average daily emissions will be used along with hours of operation and start and finish times in the model.

Sources with actual emissions of 250 tons/ year (or greater) of PM_{10}, NO_x, or SO_x (Attachment 4) will be surveyed to determine if any anomalies occurred in their processes during the episode days. This data will be incorporated into the episode modeling.

Emission points within point sources in the nonattainment area that are emitting 100 tons/year of NO_x, SO_x, or PM_{10} will be included as SIP emission points. (Attachment 5) All other emission points will be included in the area inventory and will be projected using area source methodology. This methodology will be outlined in the projection protocol.

8.1 BIOGENIC EMISSIONS

The emissions from biogenics is calculated by multiplying land area and foliage types by county by PC-BEIS software emission factors. The Geographic Information System (GIS) is used to create a land use data base with a higher degree of spatial resolution than the GEOECOLOGY data base. Since biogenic emissions are at a minimum during PM episodes, they will not be modeled.

9.1 SOIL EMISSIONS

NO_x emissions from soil are believed to be negligible during winter episodes in which the temperatures are low. The NO_x from soils will not be included in the modeling process.

10. AMMONIA EMISSIONS DATA

10.1 LIVESTOCK AMMONIA

The ammonia emissions from livestock will be estimated by multiplying the number of animals, -by type within each county of the domain-, by each applicable emission factor. Per-animal emission factors are supplied in "Development And Selection Of Ammonia Emission Factors", an August 1994 publication, written by R. Battye and his colleagues (hereafter Battye). When Battye's publication is silent for a specific animal type, an emission factor from one of several other secondary sources will supply the factors.

The annual publication, "Utah Agricultural Statistics And Utah Department Of Agriculture And Food Annual Report", will supply the number of domestic livestock animals by county and type. Company-prepared information, supplied through individual internet sites, will be used to fill any gaps in livestock numbers that may be missing from any of the above reports.

10.2 DOMESTIC ANIMAL AMMONIA

The ammonia emissions from domestic animals, namely dogs and cats, will be estimated using emission factors from the Battye report multiplied by animal-ownership statistics for county inside the domain. Due to small amount of ammonia from this source, no modifications will be made for changes in season.

10.3 WILD ANIMAL AMMONIA

The ammonia emissions from wild animals, (such as deer, elk, bear, and rabbits), will be estimated using emission factors from the Battye report (Table 6-1, page 6-3) multiplied by animals estimated by the Utah Department Of Natural Resources (DNR) by county. Temporal allocations will track with DNR recommendations. Ammonia from the ubiquitous and quickly-degraded droppings of birds and rodents are included in soil ammonia, below.

10.4 SOIL AMMONIA

Emission factors are supplied in Tables 5-1 and 5-2 of "1997 Gridded Ammonia Emission Inventory Update For The South Coast Air Basin" (GASCAB), for ten soil and land coverage materials. Soil types and coverage are determined with Global Information System (GIS) technology. Seasonal releases will be adjusted by indexing to average daily air temperatures reported by the National Weather Service.

10.5 HUMAN PERSPIRATION, RESPIRATION AMMONIA

The ammonia emissions from human perspiration and respiration, (0.55 and 0.0035 lbs per person annually), will be estimated using emission factors from the Battye report multiplied by the population of each county inside the domain. Due to small amount of ammonia from this source, no modifications will be made for changes in season.

10.6 HOUSEHOLD CLEANING AMMONIA

The ammonia emissions from household cleaning products, (0.05 lbs per person annually), will be estimated using emission factors from the aforementioned Battye report multiplied by the population of each county inside the domain. Due to small amount of ammonia from this source, no modifications will be made for changes in season.

10.7 STATIONARY COMBUSTION AMMONIA

The ammonia from the combustion of natural gas, residual oil, an digester gas will be estimated using emission factors from Table 9-3 of "Review Of Current Methodologies For Estimating Ammonia Emissions" (RCMA), written/compiled by Sonoma Technology Inc. Those factors will be combined with energy estimates reported by established fuel agencies. Seasonal releases will be adjusted by indexing to average daily air temperatures reported by the National Weather Service.

10.8 INDUSTRIAL POINT AMMONIA

Emissions of primary (by ammonia slip) and secondary (created by reaction) ammonia released from established point sources will be estimated using emission factors from Table 9-4 (page 9-13) of the RCMA document. Those factors will be combined with details about specific point sources that are identified in the domain. Seasonal releases will be adjusted by indexing to average daily air temperatures reported by the National Weather Service.

10.9 PUBLICLY-OWNED TREATMENT WORKS (POTW) AMMONIA

In the "1997 Gridded Ammonia Emission Inventory Update For The South Coast Air Basin" (GASCAB), a factor of 0.118 lbs of ammonia released per million gallons of effluent was utilized for all 32 treatment plants included in that inventory. Presuming constant conditions in Utah, this same factor will be multiplied by the effluent of each POTW inside our study domain. Seasonal adjustments will track with possible changes in effluent gallonage.

10.10 MUNICIPAL LANDFILLS AMMONIA

Ammonia emissions are indexed to methane in the GASCAB document (section 10.2) at the rate of 0.007 lbs ammonia per lb of methane, and the EPA's Landfill software model estimates methane. Seasonal releases will be adjusted by indexing to average daily air temperatures reported by the National Weather Service.

ATTACHMENT 1

ATTACHMENT 2

ATTACHMENT 3

ATTACHMENT 4

ATTACHMENT 5